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**United States Patent** [19]

Müllen et al.

[11] **Patent Number:** **5,986,099**[45] **Date of Patent:** **Nov. 16, 1999**[54] **SUBSTITUTED QUATERRYLENE  
TETRACARBOXYLIC ACID DIIMIDES**[75] Inventors: **Klaus Müllen; Heribert Quante**, both  
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**Berlin**, Munich, both of Germany[21] Appl. No.: **08/860,928**[22] PCT Filed: **Jan. 12, 1996**[86] PCT No.: **PCT/EP96/00118**§ 371 Date: **Jul. 21, 1997**§ 102(e) Date: **Jul. 21, 1997**[87] PCT Pub. No.: **WO96/22332**PCT Pub. Date: **Jul. 25, 1996**[30] **Foreign Application Priority Data**

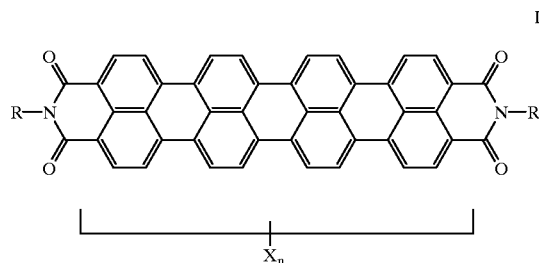
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[51] **Int. Cl.<sup>6</sup>** ..... **C09B 5/62; C07D 221/18**[52] **U.S. Cl.** ..... **546/26; 546/40; 8/636;**  
8/648[58] **Field of Search** ..... 546/26; 8/636,  
8/648[56] **References Cited****U.S. PATENT DOCUMENTS**1,715,430 6/1929 Schmidt et al. .... 502/407  
4,846,892 7/1989 Henning et al. .... 106/478  
5,405,962 4/1995 Muellen et al. .... 546/27**FOREIGN PATENT DOCUMENTS**

4236885 5/1994 Germany .

**OTHER PUBLICATIONS**Nagao, Y. et al, Dyes and Pigments, 1991, 16, pp. 19–25.  
Quante, H. et al, Angew. Chem. Int. Ed. Engl., 1995, 34(12),  
1323–1325.  
Seybold, G. et al, Dyes and Pigments, 1989, 11(4), pp.  
303–317.*Primary Examiner*—Alan L. Rotman  
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Maier & Neustadt, P.C.[57] **ABSTRACT**

Quaterrylene-tetracarboxylic diimides I



where

R is hydrogen;

C<sub>1</sub>–C<sub>30</sub>-alkyl whose carbon chain may be interrupted by  
one or more of —O—, —S—, —NR<sup>1</sup>—, —CO—  
and/or —SO<sub>2</sub>— and which may be monosubstituted or  
polysubstituted by cyano, C<sub>1</sub>–C<sub>6</sub>-alkoxy or a 5-, 6- or  
7-membered heterocyclic radical which is attached via  
a nitrogen atom and which may contain further het-  
eroatoms and may be aromatic, whereR<sup>1</sup> is hydrogen or C<sub>1</sub>–C<sub>6</sub>-alkyl;C<sub>5</sub>–C<sub>8</sub>-cycloalkyl whose carbon skeleton may be inter-  
rupted by one or more of —O—, —S— and/or  
—NR<sup>1</sup>—;aryl or hetaryl, which may each be monosubstituted or  
poly-substituted by C<sub>1</sub>–C<sub>18</sub>-alkyl, C<sub>1</sub>–C<sub>6</sub>-alkoxy,  
cyano, —CONHR<sup>2</sup>, —NHCOR<sup>2</sup> and/or aryl- or  
hetaryl-azo, which may each be substituted by C<sub>1</sub>–C<sub>10</sub>-  
alkyl, C<sub>1</sub>–C<sub>6</sub>-alkoxy or cyano, whereR<sup>2</sup> is hydrogen; C<sub>1</sub>–C<sub>18</sub>-alkyl; aryl or hetaryl, which may  
each be substituted by C<sub>1</sub>–C<sub>6</sub>-alkyl, C<sub>1</sub>–C<sub>6</sub>-alkoxy,  
halogen or cyano;X is halogen; C<sub>1</sub>–C<sub>18</sub>-alkyl; aryloxy, arylthio, hetaryloxy or  
hetarylthio, which may each be substituted by C<sub>1</sub>–C<sub>4</sub>-  
alkyl or C<sub>1</sub>–C<sub>4</sub>-alkoxy;

n is from 2 to 12,

their preparation and use as pigments or fluorescent dyes.

**9 Claims, No Drawings**